REMARKS

By way of summary, Claims 1-33 were pending in this application. No new claims are added and no claims are canceled. Claims 13, 15-18, and 31-33 are amended herein. Accordingly, original Claims 1-33 remain pending for consideration.

This application is directed to a hard disk drive with a shock event logging capability. Disk drives are operated at small tolerances, causing moving parts to be in close proximity. The moving parts are susceptible to unwanted physical contact when the disk drive experiences a shock event. Shock events are not uncommon in some environments where disk drives are used, e.g., in mobile environments and in laptop computers. Damage that may be attributed to shock events may range from a simple missed data retrieval to an unintended overwrite of data in an adjacent track. Shock can also cause physical damage (such as to the disk surface) that results in permanent loss of data. Applicant has discovered a need for a shock detection system in hard disk drives that is able to provide information about a shock event to a service provider servicing the disk drive. In particular, Applicant has discovered a need for a shock event logging system that permits improved diagnosis of shock related damages to the disk drive.

Objected to Claims Have Been Rewritten

Applicant thanks the Examiner for the indication that Claims 13, 15-26, and 31-33 contain allowable subject matter. Claims 13, 15-18, and 31-33 have been rewritten in independent form. Each amended claim now includes all of the limitations of the respective base claim and any intervening claim. Claims 19-26 depend from directly or indirectly from Claim 18. Because Claim 18 is rewritten in independent form and therefore is in condition for allowance, Claims 19-26 do not need to be rewritten in independent from to be in condition for allowance. Applicant respectfully requests allowance of Claims 13, 15-26, and 31-33.

Claims 1-9 And 27-30 Are Not Obvious In View Of Serrano And Dunphy

The Examiner rejects Claims 1-9 and 27-30 under 35 U.S.C. § 103(a) as obvious in view of U.S. Patent No. 6,226,140 to Serrano et al. (Serrano) and U.S. Patent No. 5,077,736 to Dunphy et al. (Dunphy). The Examiner states that the motivation to combine is "to detect recurring type of shocks that could be susceptible to correction in advance of a future shock by studying their source and nature having maintained a historic record of such event." In other words, the Examiner suggests that Serrano could be augmented to provide information about repeatable shock events to predict and correct for future shock events. Applicant respectfully

submits that the Examiner has not shown any motivation to combine the references, and Applicant also respectfully disagrees with the Examiner's characterization of the references. Therefore, Applicant respectfully traverses the rejection, as discussed in the following paragraph.

Serrano

Serrano is directed to a shock detector in a disk drive servo control system and a related methodology, which is illustrated in Figure 7 of Serrano. However, contrary to the Examiner's assertion, Serrano specifically teaches away from logging "recurring types of shocks" because Serrano considered a true recurring shock event to be highly unlikely. Serrano considers such a recurring shock even to be so unlikely that such a signal is ignored as erroneous. In particular, Figure 7 shows a step 702 wherein a controller 312 compares position error signal ("PES") data for each sector cell as the PES data is received. Next, in a step 704 a shock is indicated for a cell if a difference between the PES values from one sector cell to the next is greater than a threshold value. In a step 708, a write inhibit signal is provided to the write processor 324 if the number of cells from any one sector that indicate a shock is greater than a threshold value. The write inhibit signal ensures that a write operation will not take place, preventing errors in a manner similar to that described in the background section of the present application.

Serrano states that "[c]onsistent shock indications from a single cell or sector on successive disk revolutions are highly unlikely. . . ." Therefore, Serrano includes a step 710 wherein the shock detector compensates for repeated shock indications by ignoring them. Serrano states "[i]n accordance with this processing step, if any one cell (or sector) repeatedly indicates a shock from one disk revolution to another, then the shock indication from that cell (or sector) *is ignored by the shock detector 332* in determining whether to issue a write inhibit signal." Column 11, lines 10-14.

Because Serrano considered a signal indicating a "recurring" shock event to indicate an erroneous reading rather than a real shock event, it is highly unlikely that Serrano would include the components needed to maintain a log to memorialize such a signal. Moreover, including such components would be contrary to Serrano's several teachings away from including additional complex and costly components. See, e.g., Column 4, lines 7-8; Column 5, lines 6-12; and Column 13, lines 54-61.

Dunphy

Dunphy does not provide a motivation to combine anything disclosed therein with Serrano because Dunphy does not discuss an embedded servo system or devices or methods related to shock detection. In addition, Applicant respectfully submits that the "history log memory 404" is not a shock event logger, as recited in the claims.

Dunphy is directed to a disk drive memory 100 that uses a large plurality of small form factor disk drives 130-0 to 130-K to emulate the format and capability of a large form factor disk drive. Data written onto the disk drives is transmitted from an associated central processing unit over a bus 150 to one of four directors 151-154. The directors 151-154 store and transfer the data to control modules 101-104, which segment the data into N segments and M redundancy segments for error correction purposes. Dunphy suggests that this redundancy, combined with the availability of backup drives and unassigned drives, provides more reliable disk drive memory at the time. The disk drive memory 100 also includes a disk drive manager 140, which is connected to all of the disk drives 130-0 to 130-K via control modules. Dunphy states that the disk drive manager 140 includes a history log memory 404. Dunphy also states that the disk drive manager 140 "has primary responsibility for diagnostic activities within this architecture of the disk drive memory and maintains all history and error logs in history log memory 404."

Dunphy may suggest logging errors in the memory 404 but does not suggest recording shock event information. Shock events are distinct from errors. An error *can result from* a shock event, but a shock event is not itself an error. For example, an unintended overwrite of data is an error that can result from a shock event. However, in some cases, shock events do not result in errors. Therefore, even if Dunphy suggests logging errors, Dunphy does not teach recording information about shock events, which are not in themselves errors and do not necessarily lead to errors. Thus, Dunphy does not suggest that the history log memory 404 is configured to detect or store shock event data. Furthermore, no elaboration of the diagnostic activities performed by the manager 140 is provided to indicate any such suggestion. Moreover, Dunphy does not provide a motivation to combine the history log memory 404 with the Serrano system and method because Dunphy does not teach or suggest any sort of shock detection schemes or a dedicated or embedded servo system.

Claims 1-9

In contrast to Serrano and Dunphy, Claim 1 recites, among other limitations, a hard disk drive comprising "a shock event logger that records information about the shock event as determined by the shock detection system." Serrano and Dunphy fail to teach or suggest at least these limitations of Claim 1. In addition, the motivation to combine Serrano and Dunphy is lacking. Therefore, Applicant respectfully submits that Claim 1 is patentably distinguished over Serrano and Dunphy and requests allowance of Claim 1.

Claims 2-9 depend from Claim 1 and further defines the invention defined in Claim 1. For at least the reasons set forth above with respect to Claim 1, Applicant respectfully submits that Claims 2-9 are patentably distinguished over Serrano and Dunphy. Claims 2-9 also are patentably distinguished over Serrano and Dunphy in view of the additional limitations defined in Claims 2-9. Therefore, Applicant respectfully requests allowance of Claims 2-9.

Claims 27-30

Also in contrast to Serrano and Dunphy, Claim 27 recites a method of logging shock events in a hard disk drive comprising a rotatable disk having a magnetic recording media, the method comprising:

> monitoring a signal from a component of the hard disk drive that responds to at least one of displacement, velocity, or acceleration of at least a portion of the hard disk drive;
>
> evaluating the signal to determine whether the at least one of displacement, velocity, or acceleration is a result of a shock event; and
>
> recording information about the shock event.

Serrano and Dunphy fail to teach or suggest the foregoing limitations of Claim 27. In addition, as discussed above, the motivation to combine Serrano and Dunphy is lacking. Therefore, Applicant respectfully submits that Claim 27 is patentably distinguished over Serrano and Dunphy, and Applicant requests allowance of Claim 27.

Claims 28-30 depend from Claim 27 and further define the invention defined in Claim 27. For at least the reasons set forth above with respect to Claim 27, Applicant respectfully submits that Claims 28-30 are patentably distinguished over Serrano and Dunphy. Claims 28-30 also are patentably distinguished over Serrano and Dunphy in view of the additional limitations defined in Claims 28-30. Therefore, Applicant respectfully requests allowance of Claims 28-30.

Claim 10 Is Not Obvious In View Of Serrano, Dunphy, and Harwood

The Examiner rejects Claim 10 under 35 U.S.C. § 103(a) as obvious in view of Serrano, Dunphy, and U.S. Patent No. 5,491,394 to Harwood et al. (Harwood). The Examiner refers to the Abstract of Harwood as disclosing a shock detector comprising a back EMF signal processor. Applicant traverses this rejection on substantially the same grounds set forth above in connection with Claim 1.

Harwood

The shortcomings of Serrano and Dunphy have been discussed above. Among other things, motivation to combine these references is lacking. Harwood does not cure this deficiency. Harwood is directed to an acceleration sensing write disable system utilizing an actuator arm coil. In particular, Harwood discloses a hard disk drive 10 that contains a detection circuit 50 that senses back EMF generated by a coil 30b. The detection circuit 50 generates a shock detection signal when the back EMF of the coil 30b exceeds a pre-determined value. A write disable gate 76 of the disk drive 10 is disabled when the voltage detection circuit generates the shock detection signal. However, Harwood does not teach or suggest any structure for recording information about shock events.

Because Harwood does not cure the deficiencies of the combination of Serrano and Dunphy discussed above in connection with Claim 1, Harwood does not render Claim 1 obvious.

Claim 10 depends from Claim 1 and further defines the invention defined in Claim 1. For at least the reasons set forth above with respect to Claim 1, Applicant respectfully submits that Claim 10 is patentably distinguished over the combination of Serrano, Dunphy, and Harwood. Claim 10 also is patentably distinguished over Serrano, Dunphy, and Harwood in view of the additional limitations defined in Claim 10. Therefore, Applicant respectfully requests allowance of Claim 10.

Claims 11-12 and 14 Are Not Obvious In View Of Serrano, Dunphy, and Gregg

The Examiner rejects Claims 11-12 and 14 under 35 U.S.C. § 103(a) as obvious in view of Serrano, Dunphy, and U.S. Patent No. 5,930,068 to Gregg et al. (Gregg). Applicant traverses this rejection on substantially the same grounds set forth above in connection with Claim 1.

Gregg

The shortcomings of Serrano and Dunphy have been discussed above, including the lack of a motivation to combine these references. Like Harwood, Gregg does not cure this deficiency.

Gregg notes that a position error signal (PES) value can exceed a threshold value for two types of causes: (1) the head actually is positioned at a location sufficiently distant from the center of the track, or (2) a defect exists in the servo information. Column 2, line 63 – Column, line 3. Shock is a cause of the first type. Shock causes high PES that reflects actual deviation of the head from the track over which it has been positioned. However, Gregg is directed at a method of using PES samples to identify when high PES is due to a servo defect. Column 3, lines 60-65. Thus, while Gregg teaches processing of PES signals, Gregg does not provide a motivation to store any information related to a shock event or otherwise to combine the teachings of Serrano and Dunphy.

Because Gregg does not cure the deficiencies of the combination of Serrano and Dunphy discussed above in connection with Claim 1, Gregg does not render Claim 1 obvious.

Claims 11-12 and 14 depend from Claim 1 and further defines the invention defined in Claim 1. For at least the reasons set forth above with respect to Claim 1, Applicant respectfully submits that Claims 11-12 and 14 are patentably distinguished over the combination of Serrano, Dunphy, and Gregg. Claims 11-12 and 14 also are patentably distinguished over Serrano, Dunphy, and Gregg in view of the additional limitations defined in Claims 11-12 and 14. Therefore, Applicant respectfully requests allowance of Claims 11-12 and 14.

CONCLUSION

For the foregoing reasons, the Applicant respectfully submits that the present application is in condition for allowance, and the Applicant respectfully requests that a Notice of Allowance be issued at the earliest opportunity.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: October 18, 2004

By: 

Andrew M. Douglas
Registration No. 51,212
Attorney of Record
Customer No. 20,995
(949) 760-0404

AMD-6664.DOC // 101804